Sensors

Sensors

Aim: What are the different types of sensors used in robotics?

Do Now: Make a list of the sensors you already know and any information you can remember about them.

Sensors

Sensors are used for a variety of reasons:

- to help control movement and steering,
- to allow us to avoid damaging crashes, and even
- to contribute to accuracy in shooting.

They measure:

- distance,
- direction,
- acceleration,
- angle of positioning, and more.

Digital vs Analog Sensors

- There are 2 types of sensors: digital and analog
- Digital measures if it is on or off
  - Think of a limit switch; it is either hit or not
- Analog measures on a scale, usually from 0 to 1
  - Think of an accelerometer; it doesn't just measure if you are moving, but how fast you are moving

Accelerometers

- used to analyze acceleration of robot
- uses vibrations to determine speed
- connected to digital sidecar (digital I/O)
- connected to gyroscope
- multiple varieties (two-axis analog/three-axis)
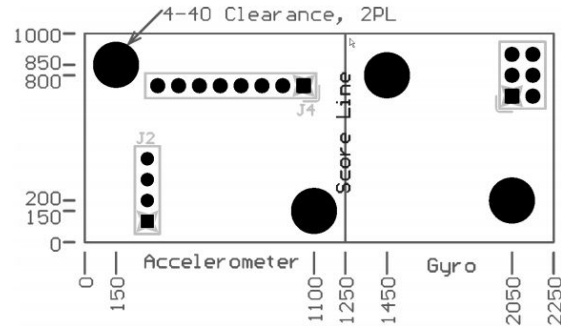
Gyroscopes

- connected to accelerometer
- uses gravity to determine orientation/angle
- includes rotor, axis, and wheel
- used for guidance/stability/control
- can be disconnected from accelerometer, wired similarly
- In order to be accurate, it needs to be at the center of the robot
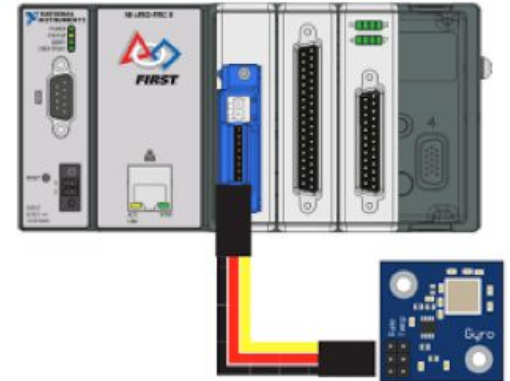
Accelerometer/Gyroscope Wiring

Accelerometer

Connect the accelerometer using either the I²C or SPI method.

I²C

- or -

SPI
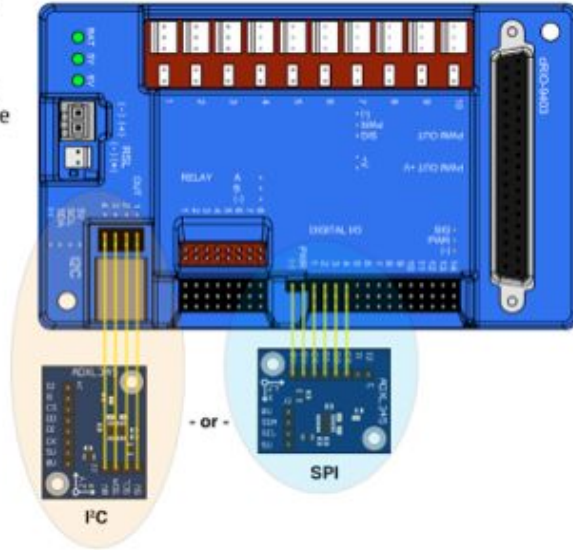
Gyroscope

Connect the rate and temp headers to the Analog Breakout as shown.

Limit Switches

upper limit switch

robot arm / elevator
255
0

lower limit switch

- used to prevent movement past a certain
point (controlled movement of arms, etc.)
- connected to signal and ground
- must be pressed mechanically by mechanism on robot
- includes 1 normally open (NO) and 1 normally closed (NC) pin
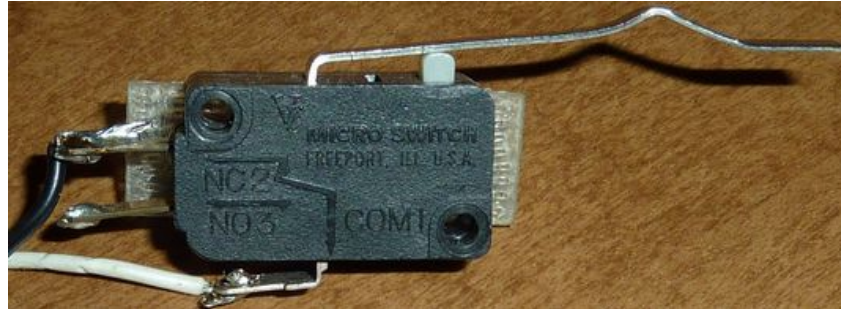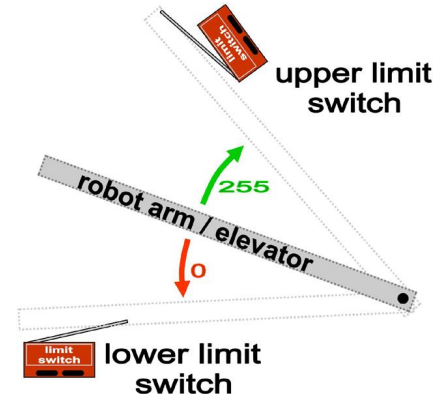
Rangefinders

- sonic sensors that emit a sound (often referred to as a 'ping')
- track distances by the amount of time it takes for the sound to return
- good for guidance and movement, prevent damaging crashes, help with scoring by sensing distance from goal
- uses speaker and microphone
- connected to roboRIO

Compass

- similar to gyro, determines orientation using magnetic field
- used less frequently than gyro, less convenient (harder to place, more temperamental, etc.), but still useful in determining orientation/angle
- must be mounted away from most electronics

(susceptible to interference)
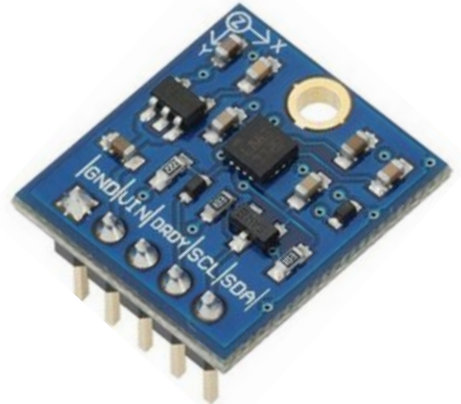
Cameras

- used for vision tracking
- multiple varieties (Axis or USB)
- connects to the VRM (voltage regulator module) and roboRIO (USB camera only)
- connects to PDB and cRIO (Axis camera only)
- able to track vision targets on field (totes, goal, etc.)

Encoders

- used most commonly with wheels
- track distance traveled
- use "ticks" that represent a certain distance (calculate how many ticks per wheel rotation and distance traveled per rotation, allow robot to go an exact distance based on desired number of ticks, useful in autonomous)
- also help control turns (have one wheel encoder go more ticks than another)
- can also connect to roboRIO

Encoders (cont.)
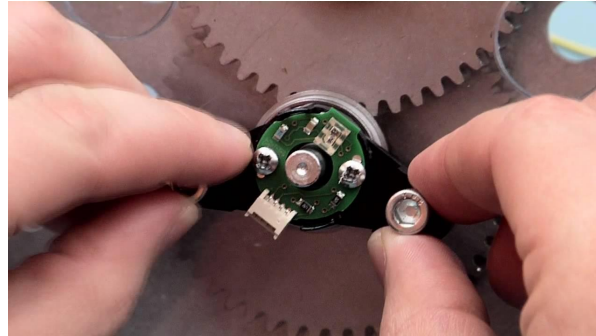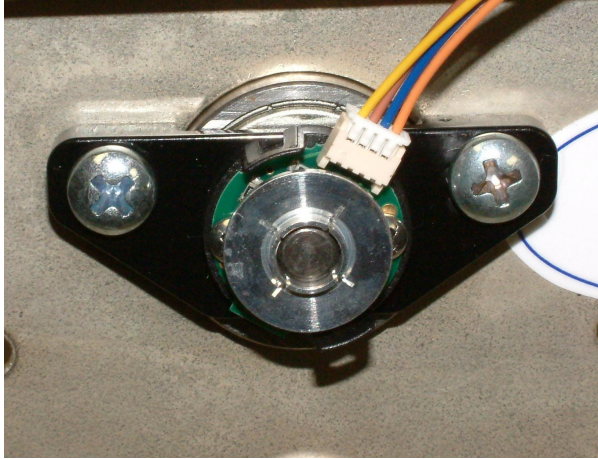
Quiz Time!

This quiz consists of 3 multiple choice review questions based on the information you have just received. Let's see how well you remember!

Question #1:

Which of the following sensors would be most useful in avoiding crashing into the field?

A. Rangefinder
B. Gyroscope
C. Encoder

Answer #1:

A. Rangefinder

Rangefinders use a sonar-like system to detect objects nearby, including elements of the field.

Question #2:

What is the main function of a limit switch?

A. Preventing robots from driving past a consistent shooting distance
B. Stopping all robot action in case of an issue or obstacle, like brakes
C. Preventing a part of the robot from moving past a preset range of motion

Answer #2:

C. Preventing a part of the robot from moving past a preset range of motion

Limit switches stop parts from moving past their preset positions, which helps in situations such as determining a scoring position.

Question #3:

True or false: A compass is used similarly to a gyroscope, but is often considered easier to work with.

A. True
B. False

Answer #3:

B. False

While a gyroscope and a compass do have similar purposes, it is generally agreed that gyroscopes are less temperamental (although compasses are still very useful).

Thanks!

Hope you learned something about sensors!

Do Now Question #1

Which are the most equipped to help with scoring?

A. Accelerometers and gyroscopes
B. Cameras and limit switches
C. Encoders and compasses

Do Now Answer #1:

B. Cameras and Limit Switches

Cameras help to track vision targets often placed on or around goals. Limit switches help to secure a preset scoring position by preventing the shooter/arm to go past the set position

Do Now Question #2

Which sensors can attach to the wheels of the robot?

A. Encoders
B. Limit Switches
C. Compass

Do Now #2

A. Encoders

Encoders are often used to track distances (when connected to the wheel) by calculating the distance traveled by 1 wheel rotation, and then the amount of wheel rotations necessary to get to a desired point.